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Investigating the on-demand service characteristics: an empirical study

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Abstract

Purpose – Technological developments and new customer expectations of immediacy have driven businesses to adopt on-demand service models. The purpose of this paper is to study the characteristics of a range of on-demand services in order to better understand the meaning of "on-demand" and its implications for service management. This enables the on-demand service logic to be applied to other service contexts, where it may add value for customers.

Design/methodology/approach – The study starts with a focused literature review and continues with a multiple case study methodology, as the on-demand service concept is in the early stages of theory development. Seven cases were studied, based on a maximum variation sampling strategy.

Findings – The results show that on-demand services are characterized by three interrelated characteristics: being highly available, responsive and scalable. Analysis further reveals that on-demand services display differences within the conceptual boundaries of these characteristics, i.e. they vary in terms of their availability, responsiveness and scalability.

Originality/value – Drawing on these findings, the study contributes to the service literature by being the first to specifically conceptualize and define the on-demand services concept and reveal three key characteristics that clarify the distinctive nature of this service type. Accordingly, on-demand services are clearly differentiated from other services. Additionally, the paper discusses the variety within on-demand services and develops an on-demand service continuum that gives detailed insights into the conceptual variations within such services.

Keywords Service characteristics, On-demand services, Access economy

Paper type Research paper

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1. Introduction

The number of services offered on-demand has grown significantly. The on-demand service model is expected to change the way businesses serve customers in almost every industry. On-demand services aim to allow customers to consume a service immediately when experiencing a need, anywhere and anytime. This is in sharp contrast with, for example, scheduled services such as public transport (Taylor, 2018). Interest in the on-demand concept first gained momentum in IT services, specifically cloud computing and Software-as-a-Service (SaaS) applications, where it has reached a level of maturity. Today, on-demand services extend beyond the IT domain (Ma and Seidmann, 2015; Mitchell and Strader, 2018; Taylor, 2018) to include mobility, parcel collection and delivery and labor/workforce provision. This growth in on-demand services is driven by technological developments ;and changing customer requirements. New customer expectations of immediacy oblige businesses to adopt on-demand models. Related to servitization, customers are also changing their focus from product ownership, through purchasing, to access to and usage of goods by means of services (Fehrer *et al.*, 2018; Schaefers *et al.*, 2016). Here, immediacy of need fulfilment is important, requiring on-demand access to goods (Taylor, 2018). The services offered by Spotify and Netflix are good examples. In the past, to enjoy music or films, consumers had to visit a shop to buy a CD or DVD or wait for a scheduled broadcast. At present, Netflix and Spotify offer, as a service, on-demand access to a large variety of films and music, anywhere and at anytime.

This paper's basic premise is that on-demand services have a unique set of characteristics, with specific implications for service management research and practice. In on-demand services, the focus is on eliminating the gap between order and fulfilment (Taylor, 2018). Although this is not a completely new idea in services, it becomes increasingly important in the context of on-demand services because it offers a key competitive advantage in the "on-demand economy" (Cockayne, 2016). The key challenge in eliminating the gap between order and fulfilment is to find ways to provide immediacy in need fulfilment at an acceptable margin without raising prices excessively. This means that on-demand service providers must appropriately balance trade-offs in immediacy, cost and standardization/customization. Among other aspects, this requires: ingenuity in deploying new technologies to serve customers in the quickest possible way; innovative procurement strategies for the resources required to provide the on-demand service; appropriate risk management strategies in guaranteeing availability; and service pricing focused on access and use rather than ownership.

This paper studies the characteristics of on-demand services to better understand the meaning of "on-demand" and the accompanying implications for service management. As argued by Lewis and Brown (2012), every service type has its own specificities, which set particular requirements for developing and managing such services. The development and management of services therefore benefits from thorough understanding of the service type's characteristics (Schumann *et al.*, 2012). The service literature, however, is not clear on how to deal with the managerial challenges of on-demand services, and despite some progress in this field (e.g. Chen and Wu, 2013; Künsemöller and Karl, 2014; Taylor, 2018), the conceptual understanding of on-demand services is limited as studies on the characteristics of on-demand services are lacking. Given this lack of theoretical insight, it is also uncertain how practical experiences with on-demand services can be translated and applied to other service contexts to add value for customers.

Following this line of reasoning, this paper explores the characteristics of on-demand services to better understand the distinctive challenges associated with their management. This objective is formulated in the following main research question:

RQ1. What are the key characteristics of on-demand services and how can the on-demand service type be conceptualized accordingly?

By answering this question, this paper generates insights that support the development and management of on-demand services and makes the following contributions to the service literature: first, the paper defines and conceptualizes on-demand services by analyzing the literature on the on-demand services concept and studying seven cases. Specifically, it reveals three interrelated key characteristics of on-demand services that clarify the distinctive nature of this service type. Second, the paper studies the variety within on-demand services and develops an on-demand service continuum to obtain insights into the conceptual differences between various on-demand services.

The remainder of the paper is organized as follows. Section 2 reviews the literature on on-demand services. The methodology is explained in Section 3, with results of the multiple case study presented in Section 4. Section 5 answers the research questions and discusses the contributions of the paper. Section 6 discusses limitations and future research, while Section 7 presents the conclusions.

2. Literature review

The study started with a focused literature review on the on-demand services concept. Based on the review results, this section concludes with a preliminary set of on-demand service characteristics and two specific sub-questions.

2.1 Approach literature review

The focused literature review is based on the methodology of Tranfield *et al.* (2003). In total, 11 databases were selected to cover most scientific publications in the field of business and related areas as economics, IT and engineering: *Thompson Reuters Web of Science, Academy of Management, Elsevier Science Direct, Taylor and Francis online, EBSCOhost Academic Search Premier, EBSCOhost Business Source Premier, Wiley online Library, InderScience Publishers, Informs, Sage,* and *Emerald Insight*. The following search string was used to search the title, abstract, and key words to find articles on on-demand services: "on-demand service" OR "on-demand service" OR "service on-demand" OR "service on-demand." No limitations were set on publication year or literature type (e.g. papers, book chapters, conference proceedings, and working papers). This resulted in 441 unique papers.

All papers were individually assessed by reading the abstract and performing a quick scan of the search terms throughout the paper to check whether business or management aspects of on-demand services where discussed. In case of doubts, papers were included. In total, 47 papers were selected. The reduction was mainly attributable to many software engineering papers on video on-demand services focusing purely on IT issues without providing insights into the on-demand concept. Then, a full paper review was performed to assess whether the papers provided insights into on-demand service characteristics. Ultimately, ten papers were selected (Table I).

Lastly, ten remaining papers were analyzed following an inductive approach (Neuendorf, 2002; Tähtinen and Havila, 2018). Because no single paper specifically studied on-demand services' characteristics, this open coding approach was used to derive characteristics of the on-demand services concept without pre-existing themes. All papers were independently coded by two researchers (Tranfield *et al.*, 2003). Subsequently, both assessors' analyses were compared and discussed by all four researchers to agree on the characteristics derived.

2.2 The on-demand service literature

The literature mentioning the term "on-demand services" has been increasing. Specific forms of on-demand services, such as video on-demand (Kalvenes and Keon, 2008), cloud computing and SaaS applications (Hou *et al.*, 2018; Ma and Seidmann, 2015) and, more recently, ride-hailing services (Alemi *et al.*, 2018), have received specific attention in the

Authors and Title	Derived characteristics of on-demand service offers							Service context	Methodology
Bai *et al.* (2018): coordinating supply and demand on an on-demand service platform with impatient customers	X		X					On-demand service platforms (e.g. Uber)	Operational modelling
Bratianu (2018): the crazy new world of the sharing economy	X		X					Sharing/access-based services	Conceptual/ descriptive
Chen and Wu (2013): the impact and implications of on-demand services on market structure		X		X				IT-based services	Economic modelling
Künsemöller and Karl (2014): a game-theoretic approach to the financial benefits of infrastructure-as-a-service		X	X					Cloud computing/IaaS	Economic modelling
Ma and Seidmann (2015): analyzing software as a service with per-transaction charges		X			X			SaaS	Economic modelling
Ng *et al.* (1999): the strategic role of unused service capacity	X		X					Services in general	Literature study and interviews
Taylor (2018): on-demand service platforms			X					On-demand service platforms	Operational modelling
Weinman (2011): time is money: the value of "on-demand"	X			X				Services in general (examples mostly cloud computing)	Conceptual/economic modelling
Weinman (2012): cloudonomics: the business value of cloud computing	X	X	X	X	X	X	X	Cloud computing services	Conceptual/ descriptive
Yao *et al.* (2005): crew pairing and aircraft routing for on-demand aviation with time window	X							On-demand air transport	Operational modelling

Table I.
Overview of literature

literature. Further, on-demand services are often linked to access-based services (Lawson *et al.*, 2016; Schaefers *et al.*, 2016) and the sharing economy (Fehrer *et al.*, 2018; Kumar *et al.*, 2018). In some cases, there is indeed a clear link between these concepts, but also an important difference: sharing resources and offering access to goods does not automatically mean these are supplied instantaneously on demand. On-demand provisioning is also often related to multi-sided platforms (Andreassen *et al.*, 2018; Hagiu and Wright, 2015; Parker *et al.*, 2016). Such platforms are frequently used by service providers to collect available resources for on-demand supply. At present, these platforms are frequently studied, focusing on topics such as pricing and capacity management (Bai *et al.*, 2018; Taylor, 2018). However, again, it is important to note that multi-sided platforms are not necessarily on-demand.

Studies on the characteristics of on-demand services are lacking. Most papers mentioning on-demand services do not focus on conceptualizing and defining such services. Some, however, describe exemplary on-demand services to clarify the service type studied (e.g. Alemi *et al.*, 2018; Bai *et al.*, 2018; Ng *et al.*, 1999; Taylor, 2018). Others provide some insights into the on-demand service concept. These papers are discussed below and an overview of the literature review's findings is presented in Table I, which shows that present literature provides no consensus on the attributes of on-demand services.

2.3 Characteristics of on-demand service offers

Weinman (2012) discusses the economic value of on-demand services for the customer and argues that "on-demand" implies that the customer can be allocated the "right quantity of resources at the right time for the right amount of time at any given time" and where only the actual usage of resources is priced. Chen and Wu (2013) also discuss "on-demand" from the adopting firm's perspective to describe the procurement of (mostly IT) externally owned resources with usage-based pricing. They argue that on-demand services offer customers direct and unlimited access to resources as they would have through owning them, but with

different cost structures, which change from mostly fixed costs to variable costs. Similarly, Künsemöller and Karl (2014) argue that on-demand computing provides capacity for processing and storage similar to a physical server owned by the customer, but that fees only apply when the capacity is used, which corresponds with the usage-based pricing argued by Chen and Wu (2013) and Weinman (2012). Although these three papers address customer implications, they hardly address what constitutes an on-demand service.

Taylor's (2018) modeling study on on-demand platform pricing argues that on-demand services supply immediately when customers experience a need. Ng *et al.* (1999) similarly state that on-demand services such as tow truck, lift maintenance, and emergency services differentiate themselves through short waiting times. Slightly different, Bai *et al.* (2018) state that on-demand service platforms offer time-sensitive services anywhere and anytime. Weinman (2012) further argues that on-demand services should react responsively, but that acceptable response times vary by service. To illustrate, 24 h is acceptable for physical book delivery, while 24 s is for eBook delivery. Lastly, Weinman (2012), argues that if cloud services can react instantaneously to changing demands and with the right amount of resources requested, perfect capacity can be offered to customers. Responsiveness or immediate supply is not mentioned by Chen and Wu (2013), Künsemöller and Karl (2014), Ma and Seidmann (2015), Weinman (2011), or Yao *et al.* (2005), the other papers covered in this literature review.

This responsiveness or immediate supply requires on-demand services to be continuously available. High availability for on-demand services or availability on-demand anywhere and anytime is mentioned by Bai *et al.* (2018), Bratianu (2018), Ng *et al.* (1999), Weinman (2011, 2012) and Yao *et al.* (2005), making this a key aspect of on-demand services. Bratianu (2018) argues in the case of access-based services in the sharing economy that a shift in the dominant business model is imminent: all consumer goods will be available as a service and all consumer services will be available on-demand anywhere and anytime. Ng *et al.* (1999) further argue that the availability of services on-demand is necessary to establish and maintain service quality and firms' differentiation efforts, and that unavailability or delay is poor service. Yao *et al.* (2005), in their modeling study on aircraft routing, state that in the specific case of on-demand aviation, availability of the service is contractually guaranteed. In contrast, Künsemöller and Karl (2014) argue that availability of on-demand instances is not guaranteed and that, depending on the criticalness of availability for customers, reserved goods might be preferable to on-demand goods. Accordingly, the degree of certainty of availability (contractually guaranteed or not) is not consistent between different on-demand services. Moreover, availability of on-demand services is not discussed by Chen and Wu (2013), Ma and Seidmann (2015) or Taylor (2018).

Compared with the inherent limitations associated with fixed resources that are owned, Weinman (2011, 2012) argues that, in the specific case of cloud computing, on-demand resource provisioning is characterized by nearly unlimited scalability for the customer. Resulting from this high degree of scalability, providing on-demand resources through the cloud ensures availability of exactly the right amount of resources at exactly the right time, providing "perfect capacity." This perfect supply of resources in an environment of ever-changing demands requires elasticity to modify resource supply, as well as a high degree of granularity of supply (i.e. sufficiently fine-grained increments of resources). For example, if a customer uses 20 servers but suddenly needs 10 or 30, on-demand services are able to scale the provision of resources appropriately to the required amount for the required duration (Weinman, 2012). Similarly, Ma and Seidmann (2015) argue that the on-demand feature of SaaS enables customers to benefit from full scalability to handle possible demand fluctuations without risk. As such, the users of on-demand services are not negatively influenced by their fluctuating demand, and the service is characterized by a high degree of scalability. Chen and Wu (2013) and Künsemöller and Karl (2014) also make this point for cloud services. Although scalability seems to be an important aspect of on-demand services, it is only discussed in the context of IT services such as SaaS and

Cloud computing, and not mentioned by Bai *et al.* (2018), Bratianu (2018), Ng *et al.* (1999), Taylor (2018), or Yao *et al.* (2005) for the on-demand service types they discuss (e.g. aviation and ride-hailing services).

Lastly, Weinman (2012), solely, argues that on-demand services should have a high degree of location independence, meaning that users should have access to the service ubiquitously and *responsively*, regardless of their location. Accordingly, the exact features of the on-demand services concept remain ambiguous in the literature.

2.4 The counterpart of on-demand services

Taylor (2018) argues that, owing to their continuous availability and immediate supply, on-demand services are in sharp contrast with scheduled services, where appointments for delivery are booked in advance. In support, Yao *et al.* (2005) argue that on-demand air transportation is a non-scheduled type of service, with random and unknown upfront demand, where passengers can directly fly anytime at request. Other examples of scheduled services and their on-demand counterparts are public transport vs on-demand ride-hailing services (e.g. Uber), movies at the cinema and on TV vs video on-demand services (e.g. Netflix), regular university lectures vs Massive Open On-line Courses, and non-acute hospital treatments vs emergency treatments. Scheduled services without clear on-demand counterparts, such as legal and consulting services, also exist.

2.5 Reflection and sub-questions

This paper is the first to review the growing literature on on-demand services. It links papers published in varied journals, supporting the creation of a body of literature currently scattered among different academic fields such as IT, business, engineering and economics.

Although the literature on the on-demand services concept is increasing, no single paper conceptualizes this service type or examines its defining characteristics. Nevertheless, the papers covered in this review enabled identification of various characteristics of the on-demand services concept (Table I). These characteristics, however, were mostly derived from modeling papers discussing specific economic or operational implications of on-demand service management (e.g. effects of pricing or capacity management) or conceptual papers/book chapters. These modeling papers often focused on a simplified and theorized service context, while the conceptual papers did not provide evidence for their arguments. Therefore, detailed empirical insights and evidence is lacking. Further, the papers generally focus on a single service context (e.g. ride-hailing, aviation or cloud services), embody different sets of the characteristics derived and do not clarify the interrelationships between characteristics. This makes it difficult to generalize findings to other contexts, and to establish a comprehensive list of key characteristics of on-demand services. Additionally, it is not clear how on-demand services differ conceptually from each other and how these differences can be made explicit to allow comparison. To address these shortcomings in the literature, this paper aims to answer the following sub-questions:

RQ1a. How do the characteristics of on-demand services relate to each other?

RQ1b. What are the conceptual differences between on-demand services, and how can these be made explicit to allow comparisons?

Answering these sub-questions requires empirical research covering a wide spectrum of on-demand services.

3. Methodology

A multiple case study research methodology is adopted with the aim of theory building (Ketokivi and Choi, 2014; Voss *et al.*, 2002). This methodology is deemed the most suitable

because theory related to the on-demand services concept is limited, with little empirical substantiation (Eisenhardt, 1989; Voss *et al.*, 2002), as Section 2 shows. In such circumstances, the case study methodology is appropriate because it enables the study of a poorly understood phenomenon in its natural setting and to gain a relatively full understanding of its nature and complexity (Benbasat *et al.*, 1987; Voss *et al.*, 2002). Further, case studies allow identification of key variables and their relationships (Gibbert *et al.*, 2008; Voss *et al.*, 2002). This study aims to generate fundamental knowledge on on-demand services without focusing on specific industries. Therefore multiple cases are included to create variety. Additionally, using a multiple case study design strengthens the reliability and validity of the findings (Miles and Huberman, 1994; Yin, 2009).

The starting point for the case study is the insight into the on-demand services concept gained in the literature review, recognizing its relevant limitations. These preliminary insights are used in an abductive manner throughout the research. An abductive approach to case research is close to inductive research, but assumes a more active role for emerging theory throughout the case study (Dubois and Gadde, 2002; Ketokivi and Choi, 2014; Voss *et al.*, 2016). Specifically, it implies continuous interplay between emerging concepts and empirical observations throughout data gathering and analysis (Dubois and Gadde, 2002; Voss *et al.*, 2016).

Further, the paper opts for a positivist approach. The work undertaken is considered free of ethical discussions and value judgements of both researchers and interviewees. Moreover, the study primarily focuses on verifiable facts concerning the features of the cases (instead of relying on interviewees' opinions), resulting in objective findings. The positivist approach is further reflected in the methodological decisions elaborated below.

3.1 Case selection and sampling strategy

On-demand services feature in various industries and, therefore, the paper develops knowledge and theory applicable to a wide range of organizations. The aim is to uncover common patterns of key service characteristics present across varying on-demand services and identify properties that differentiate the various on-demand services. Therefore, a "maximum variation" sampling strategy is used to select cases (Miles and Huberman, 1994). Additionally, a focus on only one industry or service type might not reveal the full spectrum of on-demand service characteristics.

The on-demand services concept is poorly conceptualized and defined in the literature, making the selection of suitable cases difficult. However, the literature suggests various exemplary on-demand services (e.g. Alemi *et al.*, 2018; Bai *et al.*, 2018; Ng *et al.*, 1999; Taylor, 2018), which are used in searching for similar types of cases relevant to this study. Moreover, the characteristics derived from the literature (Table I) provided additional guidance in this search.

First, a list of potential on-demand services was created. Then, seven were selected, providing a manageable number of cases with sufficient variation, and considered satisfactory for this sampling strategy (Eisenhardt, 1989; Yin, 2009). To realize "maximum variation" in the sample set, on-demand services from various service sectors such as B2B, B2C and public services are selected. Additionally, the on-demand literature predominantly discusses IT-based services (e.g. cloud and SaaS services) and platform services (e.g. ride hailing). Therefore, also on-demand services relying less on IT and services that are not platform-based are selected for a more diverse perspective on on-demand services and higher generalizability.

The selected cases were subsequently contacted to discuss conducting a case study. Both practical (e.g. time required and access to relevant managers) and theoretical matters (e.g. whether the nature of the service was genuinely on-demand) were discussed. Two contacted companies (an on-demand music streaming service and parcel collection service) were unwilling to participate. These cases were replaced by alternatives from the list. Table II describes the selected cases.

Cases	Brief description of on-demand service offered	Interviews and interviewees
A: Roadside assistance service	Offering roadside assistance services through an external network of mobile mechanics	A: product manager, and B: marketing manager (double interview) Head of brand and media Manager service operations and innovation
B: Water supply service	Providing drinking water via a dedicated pipe network	Senior engineering manager Senior maintenance manager – distribution network Senior manager–technical customer contact Sector manager–customers and market CEO
C: Video on-demand service	Offering transaction video on-demand (new movies) through the internet to various devices, such as TVs, tablets and smartphones	COO Manager IT products and platform
D: Alarm room	Answering and responding to emergency calls and activating the required emergency responders (police, ambulance and/or fire brigade)	COO – fire department Senior operations manager – police department
E: Energy flexibility services	Providing energy flexibility (primary reserve) to the transmission system operator to balance electricity demand and supply within the power grid through the smart charging of electrical vehicles	A: program manager, and B: Product manager (double interview) Head of big data and project leader Board member and business developer (interviewed twice) Project team member
F: Fire brigade	Providing emergency help in containing and fighting fires, and after major accidents and disasters	Chief officer – emergency control Duty officer and General advisor – emergencies
G: Tradesman matchmaking service	Linking people with an urgent specialized job request to an appropriate tradesman (e.g. plumbers, carpenters, electricians and glaziers)	Operations manager – customer side Operations manager – tradesmen side

Table II.
Overview of studied services and interviews per case

In the study, the unit of analysis was the service being offered on-demand within each case company. This encompassed the entire company or only a service offered. In the latter instance, data collection focused on the particular on-demand service.

3.2 Data collection

Data were mainly collected via interviews with managers of case companies. To guide data collection, an interview protocol including a semi-structured questionnaire was developed (Appendix). The semi-structured questionnaire was ideal because it provided guidance and flexibility to focus on what was unique to each case, allowing the study of varying on-demand services.

Generally, there was theoretical underpinning for the questions in the protocol. Based on the literature review, potentially important constructs (e.g. on-demand services definition, service characteristics, and management practices) were specified *a priori* and included in the questionnaire. This allows these to be measured more accurately and provides firmer empirical grounding for the emergent theory when the constructs are significant (Eisenhardt, 1989). The questionnaire followed the funnel model (Voss *et al.*, 2016), starting with general questions about the service studied and then focusing on the on-demand aspects related to the case (e.g. the on-demand service offered, associated management practices and customers' perspectives). Once the initial interview protocol was completed, a pilot interview was held to test usability (Yin, 2009). This resulted in minor changes, mostly

in the order and formulation of the questions, because it was experienced as "too theoretical" by the interviewee, which made some questions hard to answer. New insights into the on-demand services concept gained during data collection were added to the protocol for upcoming interviews. This constant updating of the protocol is a key aspect of the abductive approach to case research (Dubois and Gadde, 2002; Voss *et al.*, 2016), but also advocated by Eisenhardt (1989) and Gioia *et al.* (2013).

In consultation with the contacted individuals from the companies, interviewees were selected based on their positions, experiences and knowledge, to create a complete and profound understanding of each case. Data were collected between October 2017 and March 2018. In total, 21 semi-structured interviews were held, two of them involving two interviewees each and two the same interviewee, such that 22 people were interviewed (Table II). All interviews were conducted by the first author. Multiple visits were required to interview all necessary people. Where a manager was interviewed twice, this was to obtain answers to additional questions. Each interview lasted between 35 and 90 min (on average 55 min). With permission from the interviewees, all but one of the interviews were recorded and fully transcribed. Interview notes and transcripts amounted to 235 pages of written documentation (136,801 words). To ensure the reliability of the data, all transcribed interviews were cross-checked with the interviewees.

Other sources of evidence were also gathered, including company presentations, (informal) group discussions and company documents (e.g. PowerPoints, flyers, service contracts, websites, service smart phone applications, news items and commercials of case companies emphasizing their on-demand features). These data directly relate to the cases and were used to triangulate the gathered interview data to mitigate biases of the interviewees and enhance reliability and validity (Eisenhardt, 1989; Voss *et al.*, 2002; Yin, 2009).

3.3 Data coding and analysis

Data analysis involved within-case and cross-case analyses (Eisenhardt, 1989). The within-case analysis enabled in-depth understanding of individual cases, in their specific contexts, concerning the characteristics of the on-demand services concept, and corresponding implications for service design and management. The cross-case analysis enabled identification of common patterns and differences between cases.

Following the abductive approach to case research (Dubois and Gadde, 2002; Voss *et al.*, 2016), data analysis and coding was supported by preliminary insights into the characteristics of on-demand services gained from the literature review and data collection. Importantly, however, the coding process was not constrained by these preliminary insights. As argued by Voss *et al.* (2016), in abductive research, a template with preliminary concepts can be used to analyze data; however, the template should be adaptable to new findings and therefore not be leading.

Specifically, data analysis started with open coding of the interviews (Strauss and Corbin, 1998). To be as unconstrained and open as possible, this round of open coding was done without having the preliminary insights into the on-demand service characteristics at hand. The emerged codes were grouped according to the attributes of the on-demand service offer; management practices and properties of the on-demand service provider; and the implications for, and properties of, the on-demand service customers. All interviews were coded by the lead author. Additionally, half of the interviews were independently coded by the other three researchers. Then, the outcomes of the coding from all researchers were compared and differences were discussed until a consensus regarding the appropriate code was reached.

The open coding was followed by axial coding (Strauss and Corbin, 1998) focusing on the attributes of on-demand service offers, as this is the scope of the research. Axial coding enabled linking of the codes from the open coding with the preliminary insights into the characteristics of on-demand services, in line with the abductive approach to case research (Dubois and Gadde, 2002; Voss *et al.*, 2016). Specifically, the preliminary insights into on-demand service characteristics were compared with the concepts from the open coding to

translate and cluster the obtained concepts into higher level theoretically related themes. Then, related themes were grouped into aggregate dimensions representing the key-characteristics of on-demand services and their associated parameters (Figure 1). Finally, the data were analyzed again in a more deductive manner with the updated framework at hand to search for additional supporting quotes in the data and identify relationships between the key characteristics. Table III shows how the different concepts that emerged relate to the data (i.e. the transcribed interview quotes).

Axial coding was performed by the lead author. Subsequently, all steps in the coding process were discussed in workshops with the other three researchers, who were on purpose not initially involved in this coding process. Differing insights were discussed until consensus was reached.

4. Results

This section presents the empirical results. First, Section 4.1 presents results concerning the key characteristics of on-demand services related to *RQ1*. Then, Section 4.2 describes the interrelatedness of these characteristics, related to *RQ1a* and Section 4.3 describes the differences among on-demand services, related to *RQ1b*. Section 4.4 presents customer reasons to opt for and value on-demand services, providing understanding of the main presence of the on-demand services key characteristics. Lastly, Section 4.5 presents management practices applied in the cases to understand the implications for on-demand service management, directly relating to the underlying purpose of this study.

4.1 Key characteristics of on-demand service offers

The results characterize on-demand services as being highly available, responsive and scalable. These three interrelated and defining characteristics are visualized in Figure 1 and described below. The findings are supported by evidence from the individual cases, summarized in Table III.

4.1.1 Availability. On-demand services are characterized by a high degree of availability. The following three parameters – quantity/duration, time and location – further specify this availability. Quantity/duration refers, depending on the nature of the service, to the extent of resources that can be consumed during a service request or the duration for which one can consume the resources. Time refers to the period in which the service can be requested and consumed, for example 24/7 or only during office hours. Location usually represents the geographical area where the service can be consumed. However, in an online context, it may also represent devices (e.g. smart-TVs, tablets and smartphones). The degree of availability is bounded by quantity/duration, time and location. These boundaries can be managed and set by the service provider, but may be affected by uncontrollable external influences such as a lost internet connection in the case of video on-demand services.

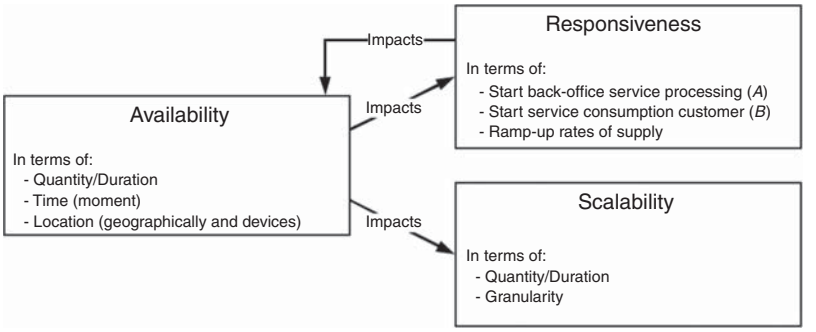

Figure 1.
Key characteristics and parameters of on-demand services, and their relationships

Evidence on availability		
A: Roadside assistance	Quantity/duration: large nationwide network of external mechanics that cooperate and provide roadside assistance. All customers' requests are always served Time: available 24/7 for service requests Location: the network of external mechanics covers the entire country	Interviewee 1: "When support is requested via the app or website, we always guarantee help. We can achieve this due to our nationwide network of independent mobile mechanics that have specific transport to provide roadside assistance. This network is well developed and large enough in scale to also meet demand in peak times"
B: Water supply service	Quantity/duration: by law at least 31 per person-day, but generally unlimited quantities and duration within boundaries of connection capacity Time: available 24/7 Location: spread across the supply district, but only at connected water tap points	Interviewee 5: "We provide 24/7 drinking water of good quality and sufficient quantity, which is our legal obligation. Generally, we have this drinking water available 24/7, although, in very exceptional circumstances, due to planned maintenance or calamity/malfunction, this might sometimes not be the case" Interviewee 2: "Everything is done to ensure that the customer can always consume, which is an essential part of our service. However, we cannot guarantee 100% availability due to external dependencies and maintenance. On average, there is a supply failure for around 20 minutes per connection per year. […] If a malfunction takes more than 24 hours to repair, we are legally obliged to provide at least 3 liters of drinking water per person per day by other means than the broken pipelines. This part is guaranteed" Interviewee 3: "In order to assure 24/7 supply of sufficient quantity, we have the necessary redundancy in our assets"
C: Video on-demand service	Quantity/duration: large number of different films available with sufficient server capacity, but limited play/viewing time after hiring Time: available 24/7 Location: geographically, everywhere in the country with an internet connection. Physically, many (but not all) electronic devices	Interviewee 1: "Our customer experience is to watch any movie you like, any time, any place and anywhere. In other words, at the moment you want it, where you want it, and on what device you want it. This in contradiction to traditional TV, which is 1 film, only 'tonight at 20:30, and only on TV. […] In our service, a customer can always choose from 2,056 titles" Interviewee 2: "In our service, we aim that every device connected to internet should be able to access our video platform. In this way, we are available on as many devices as possible, ranging from smartphones, tablets, laptops and TVs. We develop an app for every device and invest in the availability of the service" Interviewee 2: "We offer a consumer experience that needs to be seamless as the customer expects the service to be available. However, we do not contractually guarantee this as we can suffer from external disruptions. Nevertheless, we aim to provide the best possible consumer experience and availability"
D: Alarm room	Quantity/Duration: Large pool of officers available and ready to answer incoming calls. Generally, it is always possible to call the emergency services Time: Available 24/7 Location: Available everywhere	Interviewee 1: "The alarm room is always manned 24/7, but bounded by the number of officers that can respond to emergency calls, as there is a limited number of desks available" Interviewee 2: "All alarm rooms in the Netherlands support each other. This means that when one alarm room is fully occupied with calls, new incoming calls

(*continued*)

Table III.
Evidence from the case interviews on the key characteristics availability, responsiveness and scalability

	within the country provided there is a phone connection	are automatically rerouted to other rooms with officers available. This can happen in extreme scenarios, for example during a heavy storm"
E: Energy flexibility service	Quantity/Duration: Sufficiently large pool of flexible electrical vehicles available to always meet upfront contractually agreed amount of available power for the maximum agreed duration of supply Time: Available 24/7 during the contracted period Location: Not relevant, as long as devices are connected to the grid	Interviewee 2: "If you place a bid, you have to ensure that you are able to supply it. […] Placing a bid is a sort of a contract that you have to deliver on if requested, but there is no guarantee that it will be activated" Interviewee 2: "Our models predict the length of an electrical vehicle's charging session and the related available flexibility for every car connected. Clearly, this is not sufficient because customers can of course plug in or disconnect at any moment. Therefore, we over allocate cars. For example, if we make a bid of 1 MW and, let's say, we can achieve this with 100 cars, we will allocate more so that we have a reserve to cover cars connecting and disconnecting. That is, we can swop among the different cars connected – this is a safety margin"
F: Fire brigade	Quantity/Duration: Large number of fire engines and firefighters available Time: Available 24/7 Location: Fire engines and firefighters available throughout the country, but more limited in rural areas	Interviewee 2: "As a society, we have invested in a corps that should be able to serve people at any moment. […] Generally, when looking at the fire brigades in the Netherlands, there is a huge overcapacity as we have established certain response times for all regions. The response time for this region is 15 minutes. […] These response times are set by societal expectations and political decisions, and has an impact on the size and coverage plan of fire departments across the region" Interviewee 1: "This province has 735 voluntary firefighters, spread over various departments that can be called upon when needed. Further, there is one professional fire department with firefighters ready to go 24/7"
G: Tradesman matchmaking service	*Quantity/Duration:* Network of tradesmen is not always sufficient to adequately meet demand *Time:* Available online 24/7, but by phone only 0800-2200 *Location:* Service is available everywhere that has an internet connection, but limited availability of tradesmen (concentrated in larger cities)	Interviewee 1: "Our website is always available, 24/7. Customer can always submit a request here, which is then automatically sent to the tradesmen, who can decide whether to respond and accept or not. Further, our service can be requested by phone between 08:00 and 22:00 hours" Interviewee 1: "Especially in the larger cities, we have a sufficiently large network of tradesmen. However, in some regions, the more remote ones, the number of associated tradesmen is generally insufficient to make a quick match with an incoming request"
Evidence on responsiveness		
A: Roadside assistance	Response time A: immediate. After requesting roadside assistance via the app, a message is automatically sent to all associated mechanics in the area Response time B: 35 minutes on average, which is the time between a customer's service request and a mechanic arriving	Interviewee 1: "A customer's request for assistance (sent via the app) is automatically sent to a nearby local garage, who then assigns this request to a specific mechanic on the road. When this mobile mechanic accepts this job, a message is automatically sent to the app of the customer. From this moment, the customer can monitor in real time the location of the approaching mechanic" Interviewee 1: "Important in relation to the

Table III.

(*continued*)

		guaranteed help is the time until help arrives. We never make hard promises on arrival times since these can prove difficult to achieve as there can always be incidents on the road like an unexpected traffic jam. However, of course we aim to arrive as soon as possible, with average arrival times of 35 minutes"
B: Water supply service	Response time A: immediate Response time B: immediate Water is supplied at the moment of requesting water by opening a water tap	Interviewee 2: "The only thing a customer has to do is to open the tap, and the water comes out immediately"
C: Video on-demand service	Response time A: immediate After pushing the play button, the data download starts immediately Response time B: 1-5 seconds Seconds after pushing the play button the film starts (once sufficient data are downloaded)	Interviewee 1: "The customer journey is quite simple. Customers can choose from various films in the online app, select a movie, enter their e-mail, pay, and then press the play button Interviewee 2: "The moment a customer presses the play button, the streaming servers will send small four-second chunks of the film to the device of the customer in real time and start playing"
D: Alarm room	Response time A: few seconds The time between a client starting a call and the automatic response asking which services are required (fire, ambulance and/or police) Response time B: several seconds The time between a client calling and connecting with an officer	Interviewee 1: "In principle, when calling the alarm number, you are initially connected with the alarm room of the region you are calling from. An automatic reply subsequently asks for the needed emergency service (ambulance, fire department, police), and subsequently connects with an associated officer" Interviewee 2: "Although the caller is always connected with an alarm room, response times can differ in busy times. If response times by a specific alarm room are becoming excessive, the caller is automatically rerouted to another alarm room"
E: Energy flexibility service	Response time A: immediate Due to automation, service processes start immediately upon request Response time B: 30 seconds maximum The upfront-agreed amount of MW should be provided within 30 seconds of calling	Interviewee 2: "As a flexibility provider, you have a time limit within which you have to provide the offered power. As an example, if the Transmission System Operator sends you a set point for 1 MW, you have to reach that full power within the upfront-agreed timeframe that is determined by your ramp rate. So, if your ramp-up rate is 20%, you need to reach 20% of 1 MW within 30 seconds"
F: Fire brigade	Response time A: seconds The time between a fire brigade receiving the alarm and the firefighters preparing to leave Response time B: 10-15 minutes The time between a fire brigade receiving the alarm and the arrival of the firefighters at the place of the incident. However, in rural areas, it might be longer than 15 minutes owing to limited availability	Interviewee 1: "On average, the processing time at the alarm room is 1.5 minutes before we are alerted. In the case of voluntary firefighters, they take about 7 minutes to reach the department, where they need up to 2 minutes to change clothes and start the fire engine. Then, finally, it takes time to drive to the incident, which partly depends on the distance" Interviewee 1: "Generally, in 95% of cases, we arrive within 15 minutes of being alerted" Interviewee 2: "If more firefighters are needed, they come from other departments in adjacent districts. This, however, requires longer travel times. Hence, we aim to anticipate rapidly in order letting other departments arrive as early as possible"

(*continued*)

Table III.

G: Tradesman matchmaking service	Response time A: immediate After requesting a tradesman online, a message is automatically sent to all associated tradesmen Response time B: < 20 minutes After requesting a tradesman online, the customer receives a reply within 20 minutes (but not always with a match having been made)	Interviewee 1: "We aim, with our large network of tradesmen, to match up a request with an appropriate tradesman as rapidly as possible. […] We aim to respond within 5 minutes to customers with urgent requests and also aim to provide a match within 20 minutes of an urgent request. However, this is not always realized for various reasons"
Evidence on scalability		
A: Roadside assistance	Quantity/duration: limited in terms of quantity because a single mechanic with a standard repair vehicle with a confined set of tools provides the service. However, high in terms of duration, as the mechanic can take as much as time as needed to solve the problem, or eventually tow the car to the desired garage when onsite repair is not possible Granularity: highly divisible in terms of time, but limited in terms of resources and services offered	Interviewee 3: "On arrival, the mechanic diagnoses the problem and provides the necessary help. This can involve various minor repairs, such as jump-starting the car or fitting the spare wheel. However, if the mechanic is unable to repair the car at the roadside, the car can be towed anywhere (within 25 km without any additional charge)
B: Water supply service	Quantity/duration: high, as water supply can be scaled up and down easily within boundaries of connection capacity Granularity: high because customers can receive the exact amount of water required for the exact required duration	Interviewee 3: "The amount of water a customer can get per minute is not unlimited but determined by the size (diameter) of their connection with our infrastructure, which is also contractually agreed. If a customer suddenly wants more capacity, this is not always possible"
C: Video on-demand service	Quantity/duration: large but fixed number of films available to choose from and when hired a limited and fixed time to watch Granularity: In terms of quantity not relevant, because one can only rent complete films. In terms of time, highly divisible, because one can start and stop a rented film as often as one wants, but only within the restricted viewing time	Interviewee 1: "Our customer experience is not the fact that we have movies, but the fact that customers can watch them in any way they like" Interviewee 1: "The viewing experience, as we call it, starts from the moment a payment is made. From this moment, the customer has 30 days to start watching, and once they have started watching, the customer has 48 hours access in which they can pause or restart as they wish"
D: Alarm room	Quantity/duration: not relevant in terms of quantity, because each emergency call requires only one operator, but highly scalable in term time as the service lasts as long as is needed to gather all the important information Granularity: Highly divisible in terms of time, but not in quantity	Interviewee 1: "Once a caller is connected, we immediately start asking questions and once we have a good picture of the situation, we will send an emergency service (e.g. police) out as fast as possible. In the meantime, the officer will continue asking questions based on experience and training. Once we have the feeling of having a complete picture and having asked all necessary questions, the connection will be terminated"
E: Energy flexibility service	Quantity/duration: high; supply of flexibility can easily be scaled up and down within the upfront-agreed limits and time windows	Interviewee 2: "Placing a bid is not a guarantee that you will be called upon to supply but, if the Transmission System Operator needs your power, they will send a digital signal that states how much

Table III. (*continued*)

	Granularity: High, because the exact amount of flexibility (power) can be provided for the exact required duration	power you need to activate. The communicated set point indicates the MW that you need to provide, which can be up to the maximum amount you offered upfront"
F: Fire brigade	Quantity/Duration: high, because the required resources can easily be scaled up by using fire engines and fighters from other neighboring departments and for the required duration to deal with the emergency Granularity: Moderate in terms of quantity, because it can only be scaled in multiples of one fire engine plus six accompanying firefighters, but high in terms of duration	Interviewee 2: "The firefighting service is highly scalable, and with clear protocols. A "standard" house fire is dealt with by one truck. However, when there are casualties, two trucks might attend. A standardized set of circumstances is defined that indicates the number of fire trucks required and other potentially needed gear and specialists. If, on the spot, it is decided that additional fire trucks are needed, the number can be scaled up, and other departments called in" Interviewee 1: "Although many management and command processes are standardized, the actual service provisioning, such as fighting a fire, always involves customization and improvisation, because all situations are different"
G: Tradesman matchmaking service	Quantity/duration: high in terms of quantity, because a customer can make as many matchmaking requests as needed. However, not relevant in terms of duration as customers simply want a match with a tradesman as quickly as possible Granularity: Not relevant, single requests are made, taking as long as necessary to find a tradesman	Interviewee 1: "We differentiate between three types of request: urgent requests, requests for tomorrow, and requests for further into the future" Interviewee 2: "We constantly add new job categories and associated tradesmen to our service platform. Currently we already have various categories, and we will soon add a new category: floor specialists"

Table III.

4.1.2 Responsiveness. Besides high availability, on-demand services are characterized as highly responsive by having fast response times. This responsiveness is specified as the time difference between a customer's service request and either the start of back-office service processing by the service provider (response time A) or the actual service consumption by the customer (response time B), the latter being the most important for the customer because this is their waiting time. The on-demand roadside assistance case clearly illustrates this difference: when the motorist invokes the service by requesting roadside assistance through a mobile app, a message is automatically sent to all associated mechanics in the area, who can respond by accepting the request. In this case, response time A is close to zero as the back-office service processes start as soon as the service is requested by the motorist. Response time B, however, is considerably longer. On average, it takes 35 min before the mechanic reaches the customer and starts the actual service provisioning (i.e. repairing or towing away the car). Response time B is often a consequence of bridging the physical distance between service provider and customer, as in the fire brigade, roadside assistance and video on-demand cases. Although response times A and B often differ, as in the example above, they can also be similar. This is the case in the water supply service and often also IT-based services, which have near-zero response times.

Another aspect related to the responsiveness of service provisioning is the associated ramp-up rate of supply. This ramp-up rate describes how fast a service can increase resource provisioning at the start of customer's actual service consumption (i.e. response time B). This ramping up of resource provisioning is clearly illustrated by the fire brigade

service, which can summon many fire engines from neighboring stations; however, calling on these additional resources involves longer response times as they need to come from stations farther away. In the energy flexibility case, the ramp-up rates are critical and therefore specified in contracts. In some cases, however, the ramp-up rate is near infinite, meaning that all required resources are supplied immediately when the customer starts consuming (e.g. water supply or video on-demand cases).

4.1.3 Scalability. Finally, on-demand services are characterized by scalability. On-demand services typically have a highly scalable service offering in terms of quantity and/or duration. Quantity refers to the ability to offer the exact amount of required resources for a single service request. Duration refers to the ability to offer the service for precisely the required duration.

The degree of scalability is impacted by the granularity of the resources offered. Granularity refers to the divisibility of the presented resources during a service offer: a high degree of granularity implies that exactly the required quantity of resources can be provided for precisely the required duration. Scalability, in terms of quantity and/or duration, is also bounded by the amount of resources available during a service request.

4.2 Interrelatedness of the key characteristics

Availability affects both responsiveness and scalability. The degree of scalability (in terms of quantity) depends on availability because service offerings cannot be scaled up beyond the resources available. To illustrate, the fire brigade cannot provide more fire engines than the numbers available, what also applies to the water supply, video on-demand, energy flexibility and tradesmen case. In contrast, in the alarm room and roadside assistance cases, the limited amount of resources available has no impact on their scalability (which is in terms of duration) because their clients/customers use just one "unit" of resource (i.e. one officer answering the emergency call or one mechanic in a tow truck with tools). Hence, in cases where customers consume just one unit and scalability thus only applies to duration of supply, limited availability only impacts response times and not scalability.

The response time is also often dependent on service availability. When resources are limited or temporarily unavailable, this will not necessarily result in a failure to deliver, but may increase response time. The roadside assistance case illustrates this, as interviewee three argues: "An associated mobile mechanic company has a contract with us in which they guarantee to always accept a customer request in their region. However, in busy times, response times before a customer is helped may be longer." An exception is the Energy flexibility case, as interviewee 2 argues: "Placing a flexibility bid is a sort of a contract that you have to deliver on if requested." Interviewee 1 further argues: "As a flexibility supplier, you need to constantly monitor the actual available flexibility when a bid is accepted and update the power system operator accordingly." Hence, increased response times due to limited or temporarily unavailability do not occur.

Responsiveness also impacts the availability of a service. The faster a service can respond to a request (i.e. response time B), the sooner it is available for consumption. To illustrate, internet services such as video on-demand are generally able to supply instantaneously upon request, making the service directly available for consumption. However, with a limited internet connection, response times increase and customers can have difficulties in streaming. This results in long-lasting or frequent loading times in which the service is unavailable for consumption. As Interviewee 2 argues: "The moment a customer presses the play button, the streaming servers send small four-second chunks of the film to the device of the customer in real time and start playing. […] A sound internet connection, however, is required for a seamless experience." Another example is

the roadside assistance case: when a mechanic heading toward a customer is stuck in a traffic jam, the response time increases and therewith the time the service is not available for consumption.

4.3 Variety among on-demand services

Although all three characteristics are present in every studied case, there is variety among the services (Table III), both within the key characteristics (i.e. variation in the degree of availability, scalability, and responsiveness) and beyond.

4.3.1 Variety among the key-characteristics. Concerning availability, in terms of quantity/duration, the results show that the tradesmen service only has a sufficiently large network of tradesmen in a few major cities. To a lesser degree, this also applies to the fire brigade because it has fewer resources (fire engines and fighters) available in remote areas. At the other extreme, the water supply company has ample resources to always provide drinking water; similarly, the energy flexibility service has sufficient resources to service its clients. In terms of time, the tradesman service is only fully operational between 8:00 and 22:00 h, but all the other services are available 24/7. Concerning location, the video on-demand and roadside assistance services are available everywhere provided there is an internet connection linked to a suitable device, while services such as the tradesmen and fire brigade are more limited in rural areas. In addition, although the water supply service provides a nationwide service, it is only available at water taps connected to the infrastructure.

In terms of response time A, the results show that most services start immediately after a customer request (video on-demand, roadside assistance, energy flexibility, water supply, tradesmen). Further, the alarm room and the fire brigade take only a few seconds to start the service process. Concerning the response time B, the water supply service is the most responsive, with instantaneous supply on request (by opening the tap). The roadside assistance case, at the other extreme, takes on average 35 minutes to reach the customer and start providing the actual service.

Scalability in terms of quantity is not in issue in the roadside assistance service because a customer only ever requires one mechanic with a tow truck and tools. However, there is some scalability in service provision in the sense that the mechanics can offer a small variety of onsite repairs with the tools available in the truck. In terms of duration, the service offer is quite scalable in that the time spent on a service interaction is determined by the problem and can vary significantly. The situation is different with the video on-demand service in that customers have limited time to access a movie after renting it. The results also show differences in terms of granularity. The fire brigade, for example, has a low level of granularity in terms of quantity of resources in that each fire engine is always accompanied by six firefighters. The opposite extreme is seen in the water supply and energy flexibility services, which provide exactly the required amount of resources. Note, however, that all these three services provide their services for precisely the required duration.

4.3.2 Variety beyond the key characteristics. In addition to the variety within the conceptual boundaries of the three key characteristics, data analysis revealed that on-demand services vary in terms of pricing and the role of service contact and contracts. Several cases adopted a pure usage-based pricing (the roadside assistance, video on-demand and tradesmen services), while the energy flexibility and water supply case had combinations of both usage-based pricing and flat fees. Being public services, the alarm room and fire brigade services had no specific form of pricing for users.

Concerning service contact and contracts, surprisingly, only two cases (water supply and energy flexibility), required customers to establish service contracts before service

consumption. These contracts specify the boundaries of on-demand service offerings and the associated prices. In the other cases, customers do not require contacted or signed contracts with the service provider in advance. The roadside assistance, video on-demand and tradesmen services can simply be requested when needed. This is also true for the alarm room and fire brigade services, although the situation is different in that these are public services.

4.4 Customer perspective on on-demand services

The studied cases revealed three main reasons customers request and value on-demand services: first, the nature of the demand for on-demand services is generally unpredictable/impulsive and fluctuating. As Interviewee 1 from the roadside assistance service argues: "The individual demand is hard to predict as it is linked to vehicle breakdowns, which happen randomly." Interviewee 1 from the video on-demand service similarly argues: "We have no clue upfront what videos our customers are going to watch, they will not inform us in advance. Therefore, we need to keep a large number of videos continuously available in our digital store, ready to stream to potential customers." This unpredictable and fluctuating nature of service demand is present in all seven cases.

Second, customers of on-demand services value immediacy of demand fulfilment. As Interviewee 1 (roadside assistance service) observed: "It is important for our customers that they can use our service at the moment it is required, because a car breakdown is always an inconvenient event. […] Therefore, when the customer needs it, the service should be available for consumption." Similarly, Interviewee two (tradesmen service) added: "As a service provider, we reason from the perspective of the customer, having a problem that needs to be solved as quickly as possible by a specialized tradesman. Therefore, the customer can propose a convenient timeslot, and we will contact and contract a tradesman for that time as fast as possible." This immediacy is also present in all studied cases.

The third reason customers value on-demand services is the desire to be independent and in control of service consumption. As Interviewee 2 from the video on-demand service explained: "For the customer, an important feature of an on-demand service is its guaranteed availability. As a customer, you want to be in control, meaning that whenever you want to watch a movie, it should be possible to immediately start watching one using the video service." Interviewee 1 from the same provider added: "The customer no longer likes conventional TV, they want to watch TV programs or films at the moment they want to. […] People are busy, resulting in an increasing need to be in control of their own time use, and do not have the time to follow prescheduled broadcasts. […] Accordingly, our customer experience is not the fact that we have movies available, but that customers can watch when and how they like. That means being able to choose the movie they want to see, and to start, stop, and pause whenever wanted." This customer control was only present in the video on-demand, energy flexibility and roadside assistance services.

4.5 Provider perspective on offering on-demand services

The cases studied revealed several management practices that enable highly available, scalable and responsive services. These are briefly presented in Table IV, and the implications are discussed in Section 5.3.

5. Discussion

5.1 Preliminary

The characteristics found in the case studies show differences and commonalities with the ones initially found in the literature review. Three characteristics (i.e. availability,

On-demand service management practices	
A: Roadside assistance	On-demand procurement of key resources (independent mobile mechanics) Multi-sided platform model to procure and deploy key resources Large and geographically dispersed network of key resources close to the customer Contracts and SLAs with suppliers of key resources Highly standardized service processes Usage-based pricing
B: Water supply service	Centralized production with dedicated infrastructure to supply customers responsively Redundancy in infrastructure and production Highly standardized service processes Usage-based pricing and fixed connection fee
C: Video on-demand service	On-demand procurement of key resources (computing power) Contracts and SLAs with suppliers of key resources Centralized production using internet infrastructure to swiftly supply the customer anywhere Highly standardized service processes Usage-based pricing
D: Alarm room	Sharing key resources (officers/phone operators) with other alarm rooms Centralized location directly accessible via telephone/internet Highly standardized service processes No pricing for users
E: Energy flexibility service	On-demand procurement of key resources (independently owned EVs) Multi-sided platform model to procure and deploy key resources Sufficiently large network of electrical vehicle drivers Contracts with suppliers of key resources (electrical vehicle drivers), but without SLAs Dedicated infrastructure (smart electrical vehicle charging stations) connected to the power grid to supply services Highly standardized service processes Usage-based and availability pricing
F: Fire brigade	Sharing key resources (fire trucks and fighters) with neighboring areas Geographically dispersed network of fire stations close to the "customer" Highly standardized service processes No pricing for users
G: Tradesman matchmaking service	Establishing a large and geographically dispersed network of key resources (independent tradesmen) close to the customer No contracts with customers and tradesmen Highly standardized service processes Usage-based pricing

Table IV.
Service management practices

scalability and responsiveness) were found both in the literature and the studied cases. While their interrelationships were unclear in the literature, the case studies clearly enlightened this (Figure 1). Further, while "location-independent supply" and "granularity of supply" both emerged from the literature as standalone characteristics, they are labeled in the final conceptualization as parameters of availability and scalability, respectively. The specification of the key characteristics with parameters is an insight that emerged from the case studies. Further, while the literature often links usage-based pricing to on-demand services, the cases studied showed various pricing logics. Lastly, where "highly standardized supply" emerged as a characteristic in the literature, the case study learned that offering standardized services is more a means to supply on-demand, than an aim in offering services on-demand.

5.2 Theoretical contributions

This study explores the key characteristics of on-demand services and contributes valuable empirical insights into this service type. This section discusses the main theoretical contributions by answering the following research questions:

RQ1. What are the key characteristics of on-demand services and how can the on-demand service type be conceptualized accordingly?

RQ1a. How do the characteristics of on-demand services relate to each other?

RQ1b. What are the conceptual differences between on-demand services, and how can these be made explicit to allow comparisons?

To date, the service literature had not studied the characteristics of on-demand services. Based on analysis of the literature on on-demand services and empirical evidence collected from multiple cases in different service contexts, a key finding and contribution of this paper is that on-demand services can now be described using three interrelated characteristics. Based on these three key characteristics, an idealized on-demand service is now defined as "a ubiquitously available service able to instantaneously supply the exact required amount of resources for the exact required duration, at the moment they are requested by the customer." This definition is an advance in that it is based on characteristics determined via an empirical study covering a wide spectrum of services. This gives it firmer theoretical grounding and generalizability than other existing definitions that have predominantly focused on a single service context (generally IT). Furthermore, now that the characteristics of on-demand services are known and a comprehensive definition has been proposed, on-demand services can be better compared and contrasted with other not on-demand services such as scheduled services.

In answering *RQ1b*, this paper additionally contributes the development of an on-demand service continuum as a basis for providing detailed insights into the variety among different on-demand services (Figure 2). As shown, on-demand services vary in the extent of their availability, responsiveness, and scalability. Therefore, some on-demand services are closer than others to the idealized on-demand definition. Therefore, an on-demand service continuum is proposed, specified for each of these three characteristics. At one end, there is a perfect on-demand service offering that performs optimally; however, this is almost impossible to achieve in practice, especially for all three characteristics at the same time. Farther from this end of the continuum are "on-demand" services that only partly satisfy the all-encompassing definition and perform less well in terms of one or more of the on-demand characteristics. No matter how far deviated from the optimal, a service that pursues being on-demand can always be labeled as on-demand when the three characteristics are present to some degree.

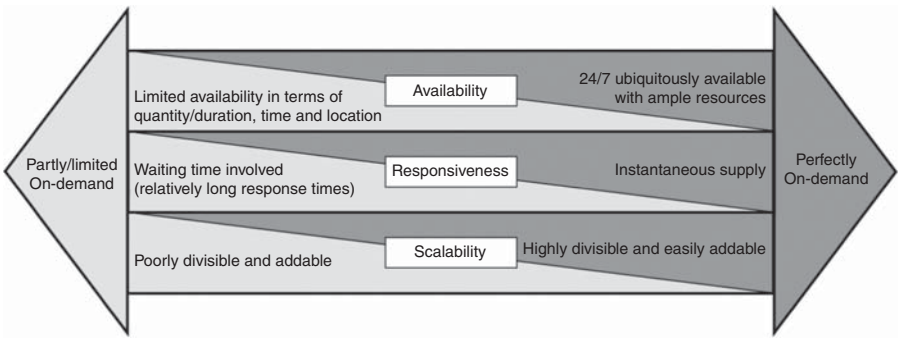

Figure 2.
On-demand service continuum

This, however, might result in a poor quality on-demand service offering. This on-demand service continuum is a novel concept in the service literature and clarifies how various on-demand services might differ from each other within the conceptual boundaries of the three defining characteristics. It should be noted, however, that the variations in on-demand services for different service types must be considered in context. Comparisons between on-demand services are only meaningful when considering services with similar norms in terms of availability, responsiveness and scalability.

5.3 Customer perspective: the need for on-demand services

Insights into the customer reasons to opt for on-demand services contribute to a better understanding of the specific characteristics of on-demand services, their main presence and the value on-demand services add over other services. The results showed three reasons for customers to request and value on-demand services over others. One reason is the rather unpredictable and fluctuating nature of demand for on-demand services, which makes it difficult for service providers to anticipate demand early. Weinman (2011, 2012) similarly argues that when demand is unpredictable and highly volatile, on-demand provisioning generates clear additional value relative to a fixed resources strategy. Moreover, he argues that when demand is constant or predictable, on-demand provisioning has no added value. In these situations, service provisioning can be scheduled.

The results also show that customers value the ability to consume a service as soon as it is needed. Taylor (2018) and Bai *et al.* (2018) similarly assert that on-demand service customers are sensitive to delays and desire immediate service provision after experiencing a need. This immediacy arises from various reasons such as emergency (e.g. fire or car breakdown services), business reasons (economic impact of waiting), or comfort and convenience (watching films, using the internet). Bai *et al.* (2018) further argue that the increasing on-demand services also amplifies the expectations and demands of customers for immediate service supply. Realizing this immediacy requires availability and responsiveness of services.

Lastly, customers value being independent and in control of service consumption. The latter is especially evident in consumer services and reflects the trend of switching from buying and owning goods to using goods through on-demand offerings (Lawson *et al.*, 2016). Although customers do not necessarily want to own goods, they still desire the same immediate access and control over use as owning them would enable (Bratianu, 2018). Customers want to independently determine when and what service to consume and how much to spend financially. This requires services that are available and scalable to be able to always fulfill the exact needs with a usage-based pricing.

5.4 Provider perspective: on-demand service management

On-demand services have a unique combination of characteristics with specific implications for service management. This section discusses the key challenge on-demand companies face and potential management practices to offer highly available, scalable and responsive services. The key challenge on-demand companies face is finding the best trade-offs in the degrees of being on-demand (i.e. in terms of availability, responsiveness, and scalability) vs the associated costs and standardization of service offerings. Interviewee 2 of the fire brigade case argues: "The targeted response time for this region is 15 minutes. […] The response times are set by societal expectations and political decisions, and have an impact on the size and coverage plan of fire departments. […] Response times can be reduced, however, at a cost."

The results showed that specific service management practices are commonly used to provide services on-demand and deal with trade-offs. One practice, applied in all cases, is to use standardized service processes. The alarm room and fire brigade both follow highly

standardized protocols, while the other service offerings are highly automated through IT. This use of standardized service processes enables high availability and responsiveness. However, one drawback is that adopting standardized service processes limits the ability to customize, resulting in a poor fit with consumer needs (Ma and Seidmann, 2015). Customization, nonetheless, is mainly realized via scalability (quantity/duration) allowing customers to consume exactly what they need.

To achieve responsiveness, it is essential to either have a robust and dedicated network (e.g. internet, telephone or water pipes) that enables access to one or a few central locations of the service provider, or to have multiple distributed smaller locations closer to customers to deal with response time issues. An innovative way to be close to the customer and reach them responsively without investing heavily on key resources is to adopt a multi-sided platform model, as the roadside assistance and tradesmen services do. As Bai *et al.* (2018) argue, to meet fluctuating customer demands anytime and anywhere, it is economically attractive for on-demand service providers to adopt a multi-sided platform model and use many independent providers to quickly fulfill customer demands. However, the cases studied also showed that using a network of independent providers can be challenging because the participation and availability of these providers is inherently difficult to manage. Another inventive – and less costly – practice to deal with response time issues is to improve customers' "waiting" experience, for example by informing customers of the expected waiting time and location of approaching service providers, as in the roadside assistance case. This creates less uncertainty for the customer and enables them to do other things while waiting.

Another frequent observation was that most providers have built ample capacity into their service systems, allowing them to easily scale up or down their service output to guarantee availability and support responsiveness and scalability. Although ample capacity seems common in on-demand services (Ma and Seidmann, 2015; Ng *et al.*, 1999), on-demand service providers inevitably need to optimize their service infrastructure capacity to reduce costs to remain competitive. In addressing this, different approaches are used in the cases studied. Some of the cases use a shared pool of common resources with other parties, somewhat based on the principle of "statistical multiplexing" in which capacity is shared by multiple parties. This is made possible by demand variations over time, enabling more efficient use of available capacity (Künsemöller and Karl, 2014; Weinman, 2011). Both the alarm room and the fire brigade cases share key resources (alarm room operators and fire engines) with other alarm rooms and neighboring fire stations during local peak demand. However, a drawback of using a shared resources pool is that a high degree of standardization is required, leading to commonality in supply (Weinman, 2012). Other cases used externally owned on-demand capacity or resources as input for their own on-demand service provision. The cases adopted different approaches in acquiring external on-demand capacity. The video on-demand service hires on-demand available computing power, which is managed by a professional supplier, to stream movies. The roadside assistance, energy flexibility, and tradesmen matchmaking service acquire externally owned on-demand capacity by using the multi-sided platform model. Both forms, however, create a kind of "on-demand supply chain or network." Establishing such on-demand supply chains and using techniques such as statistical multiplexing can increase efficiency. However, it also increases dependencies and potential risks of being unable to supply, as recognized by Künsemöller and Karl (2014). This is especially apparent in the cases where resources acquired can also be used by other parties (e.g. the roadside assistance and tradesmen services) or have other purposes (the electrical vehicles in the energy flexibility services). Coordination between suppliers in the chain and adoption of appropriate risk management strategies is therefore important (Andreassen *et al.*, 2018).

5.5 Managerial implications

Beyond its theoretical contributions, this study also has practical implications for on-demand service management. The detailed characterization developed has practical relevance as it provides a basis for detailed understanding of a specific service's peculiarities, which will prove valuable in developing and managing related on-demand services. Not every on-demand service needs to fully achieve the ideal position on the continuum. Becoming on-demand (i.e. moving to the right of the continuum) is hard and requires careful balancing of trade-offs with costs and customization. Hence, on-demand service providers should understand, in terms of the on-demand characteristics, their customers' needs and their competitors' offerings in relation to these needs. The proposed continuum can be used to operationalize and measure this. Subsequently, having specified the on-demand requirements for each characteristic of the continuum, appropriate targets can be set. Accordingly, practitioners can use the on-demand service continuum as a management tool to steer their service offerings toward the on-demand requirements of potential customers.

6. Limitations and future research

The study and its associated limitations give rise to several possibilities for future research. First, additional cases that differ from the ones covered in this study should be examined to achieve firmer theoretical grounding and confirm the results. Some potentially interesting cases include cloud computing, car-hailing and hospital emergency services. Second, although the paper discusses service management practices linked to on-demand services, further research is needed. What, for example, are good management practices that contribute to high degrees of availability, responsiveness and/or scalability? What are the negative consequences of adopting an on-demand service model and the associated trade-offs (e.g. higher costs and reduced customization)? What can be learnt from existing on-demand services (mostly in IT) regarding such management practices and trade-offs, and how can these insights be applied in other service contexts? Another aspect that would benefit from further research is the management of risks in on-demand supply chains. Lastly, a better understand of the customer implications is required, especially in perspective of the changing focus from ownership to access, in which on-demand services can play a pivotal and enabling role.

7. Conclusions

Although the on-demand service model is expected to change how businesses in almost every industry serve customers, a thorough understanding of the characteristics of this service type, along with a corresponding definition has been lacking. This empirical study fills this gap and describes the characteristics of the on-demand services concept by systematically reviewing the literature and studying seven on-demand services in a range of domains.

The main contribution of this paper to the service literature is in defining and conceptualizing on-demand services. Three interrelated key characteristics of on-demand services are identified that clarify the distinctive nature of this service type: high availability, responsiveness, and scalability. Based on these characteristics, an idealized on-demand service is now defined as "a ubiquitously available service able to instantaneously supply the exact required amount of resources for the exact required duration, at the moment they are requested by the customer." Further, because not every on-demand service is the same, the paper discusses the variety in on-demand services and developed an on-demand service continuum that can provide detailed insights into the conceptual differences between on-demand services.

A thorough understanding of the characteristics of a service is important to support its development and management (Schumann *et al.*, 2012). As the results show, on-demand services have a unique combination of characteristics, with specific implications for service operations management. Understanding of these characteristics is valuable for assessing the implications for on-demand service management and the trade-offs necessary when developing and offering such services. Although some implications are discussed in this paper, further research into the implications for service management and customers is required. Nevertheless, the insights gained into the characteristics and the associated continuum of on-demand services can be used by practitioners in developing and managing new on-demand services. Organizations aiming to offer on-demand services can use the developed on-demand service continuum to configure their service offering in such a way that it reflects to customer demands and outperform competitors.

Therefore, to conclude, the main contributions of this paper – the three interrelated characteristics, the associated definition, and the service continuum of on-demand services – result in a novel conceptualization of on-demand services and add new knowledge and understanding with relevance for both academics and practitioners.

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Appendix. Interview protocol

A: general questions about the case

(1) Can you precisely describe the service offering?

(2) Can you describe the entire service process from a customer's perspective?

(3) Can you describe the organization around the service?

- What happens behind the scenes when offering this service to the customer?
  - Departments, activities, organizational structure, size

(4) What exactly is your role in this organization and in offering the service?

B: on-demand aspects of the service offering

The service your organization offers is specifically profiled as being on-demand.

(1) What is, in your terminology, in general, an on-demand service?

(2) How is that reflected in the service offered by your organization?

(3) Why is the service offered as being on-demand?

(4) Is it possible to offer the service as not being on-demand?

- What would change?
- What is the impact for the customer?

(5) Is the availability of your service guaranteed?

- Is this an essential part of your on-demand services?
- What exactly is guaranteed in the availability of the service?
- Are there any boundaries to this availability?
- How is this guaranteed?

Hand-out definition to interviewee

(1) Is the definition applicable to the on-demand service offered by your organization?

- Why/Why not?

(2) Is the definition complete, precise, and comprehensive?

- Do you have other suggestions, adjustments, or additions to make it a better fit?

C: challenges and particularities in managing the on-demand service

(1) What are the specific challenges your organization faces in offering and managing the on-demand service? (link with the attributes mentioned under part B, e.g., availability, responsiveness, and scalability).

- What are the exact causes of these challenges?

(2) How are these specific challenges dealt with?

- Are there any specific activities, technologies, or management practices that support offering the on-demand service?

(3) Have there been other challenges in the past that now have been resolved?

(4) How is the on-demand aspect in the development/creation of the service dealt with?

- What required particular attention, and why?

(5) How would you characterize the nature of demand for your service?

- What are the consequences and challenges resulting from this nature of demand?

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